CASE REPORT

Conversion of a long distally fixed uncemented revision femoral stem to a proximally fixed implant following fatigue fracture

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ABSTRACT: *There has been increasing focus on bone conservation through proximal fixation in primary hip arthroplasty. However, the debate regarding fixation in revision arthroplasty and which factors influence implant choice remains less clear-cut. We report a case involving fatigue fracture of a long, distally well-fixed, uncemented revision stem. This was revised to a proximally fixed implant. This case highlights a number of issues when considering the choice of implant in hip revision surgery and raises the issue of bone conservation in revision surgery. We would suggest that in both primary and revision hip arthroplasty meticulous pre-operative consideration of the choice of implant should be undertaken, especially in the younger patient with higher expectations and functional demands.*

KEY WORDS: *Revision, Arthroplasty, Bone conservation, Proximal fixation*

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INTRODUCTION

As primary and revision hip arthroplasty rates increase in an active, ageing population with high outcome expectations, failure of femoral revision prostheses, their extraction and subsequent reconstruction is likely to become increasingly common (1). In the younger patient, who may require a number of revision procedures during their lifetime, sacrifice of proximal bone stock during revision surgery will compromise future re-revision, potentially leaving the patient with reduced function and at increased risk of peri-prosthetic and prosthetic fracture (2). We describe a case involving fatigue fracture of a revision stem, its subsequent removal and conversion to a proximally loading implant. To our knowledge this is the first case reported in the literature involving conversion of a long, uncemented, distally fixed, revision stem to a proximally fixed implant. This highlights some of the issues surrounding the routine use of distally fixed stems in younger, more active patients and potential strategies for improving outcome following prosthetic failure.

CASE REPORT

An otherwise fit and healthy 59-year-old male underwent primary cemented left total hip replacement in July 1996 for severe primary osteoarthritis. Aseptic loosening led to increasing discomfort and the hip was revised in July 2002 using the Zimmer Modular Revision Trilogy System (Zimmer, Swindon, UK). His recovery was uneventful, with a post-operative Oxford score of 14 at three months. In December 2002 the patient presented again with sudden onset left hip pain and inability to weight bear after feeling a ‘click’

Fig. 1 - *Anteroposterior radiograph of the left hip with fractured revision femoral prosthesis.*

Fig. 2 - *Photograph showing the extracted femoral stem with groove created by high-speed burr and the looped stem extraction device. Note evidence of osteointegration along the entire length of the stem.*

whilst walking. Radiographs showed an isolated fracture of the femoral prosthesis at the junction of the stem and the shoulder (Fig. 1). Careful pre-operative assessment confirmed that it would be possible to use a more conservative proximally fixed implant for the second revision procedure.

A long postero-lateral incision was utilised and the femoral head and shoulder removed. Intra-operative specimens showed no evidence of infection. Fracture of the prosthesis at the junction of the shoulder and stem was confirmed. The long femoral stem was found to be well-fixed along its entire length. Two limited transverse osteotomies were made approximately 1 cm and 13 cm distal to the lesser trochanter. Due to the thin cortices and excellent osteointegration, it was not possible to cleanly elevate the osteotomised section from the stem. The bone was therefore elevated in large fragments taking care to preserve soft tissue attachments. With the middle part of the stem exposed, flexible osteotomes were used to disengage the proximal calcar from the stem and so preserve adequate proximal bone stock.

As the stem had fractured below the shoulder, conventional extraction devices could not be utilised and, despite the use of flexible osteotomes, the remaining four centimetres of distal stem remained well fixed. To preserve the distal bone a high speed burr was used to cut parallel grooves into either side of the proximal stem, allowing a looped stem extraction device to be fitted, which provided enough purchase to remove the stem (Fig. 2). The fragmented bone identified on the middle part of the stem was not thought adequate to provide good structural support. Pre-operatively we initially planned to use a cadaveric femur to create a cylinder through which the new stem could pass. However, the diameter of the allograft femur was not sufficient to leave enough viable cortex after reaming to accept the stem. We therefore split the donor bone to create strut grafts and, in conjunction with the remaining femoral fragments and soft tissue attachments, used it to reconstruct the femoral defect around an SROM stem (DePuy, Leeds, UK) using three cerclage cables. Proximal fixation within the preserved proximal bone was achieved with an SROM hydroxyapatite coated proximal sleeve (DePuy, Leeds, UK).

A stable femoral construct was therefore achieved by preservation of the proximal bone stock, allowing the existing distal fixation to be converted to proximal fixation, while

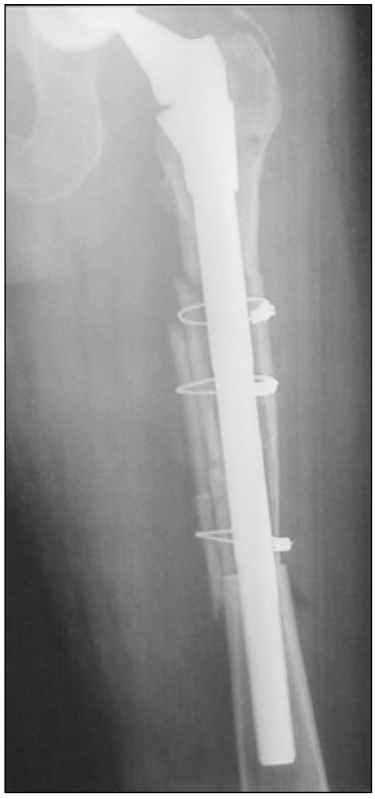

Fig. 3 - *Anteroposterior radiograph of the left femur immediately following re-revision.*

the distal femur was reconstructed with structural allograft (Fig. 3). The patient was nursed on a split bed for eight weeks, which allowed flexion and extension exercises at the knee joint. When evidence of minor callus formation was seen on post-operative radiographs he started partial weight bearing with physiotherapy. At 12 weeks he began full weight bearing. Eight years post operatively the patient remains fully mobile, with a good range of motion in both his hip and knee. He maintains his active lifestyle, which includes regular ballroom dancing and gardening. Pre-operatively his Oxford score was 59 and at his most recent follow up this was 14, with a Harris score of 94.15. Subsequent radiographs have shown excellent bone remodelling and an implant that remains stable and well fixed (Fig. 4).

DISCUSSION

To our knowledge this is the first reported case involving conversion of a long, uncemented, distally fixed revision femoral stem to a proximally fixed implant. Pre-operative planning is essential to obtain a good surgical outcome (3-5). The patient's young age and pre-morbid activity level made further revision in the future an important consideration. Radiographic evidence of good proximal bone stock suggested conversion to a proximally loading implant was a viable surgical option. The original revision stem had fractured at the junction with the shoulder and could not be removed by conventional extraction devices. The extended trochanteric osteotomy is often the approach of choice when trying to remove well-fixed stems (3, 4, 6), although an overstem reaming device can also be used. However, the considerable length of the failed stem in the presence

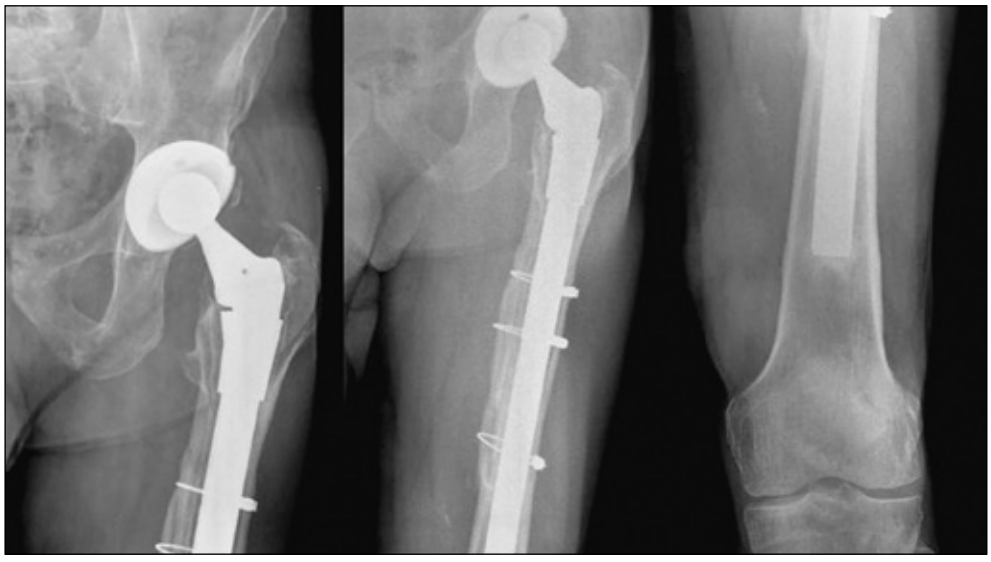

Fig. 4 - *Anteroposterior radiographs of the left hip and femur eight years post-operatively.*

of thin cortical bone and excellent osteointegration meant both options were likely to sacrifice a significant amount of proximal bone, leaving little bone stock for stable distal fixation. This would require extreme distal fixation with little proximal bone support and reduced stability, which are recognised as contributing to the development of proximal stress risers and prosthetic failure (2). Two limited transverse osteotomies over the middle part of the prosthesis allowed preservation of the entire proximal bone stock, thus allowing a proximally loading implant to be used.

The initial pre-operative plan to use cadaveric femoral allograft to reconstruct the bone defect following osteotomy was complicated by failure to specify the diameter needed. Had the correct diameter been ordered then the stability of the construct could have allowed immediate post-operative weight bearing.

Fatigue fracture of the femoral component following revision arthroplasty is a recognised though relatively rare complication (2). Because hip arthroplasty is now performed on increasing numbers of young patients with high expectations and activity demands, failure of femoral revision prostheses and their subsequent extraction and replacement is likely to become increasingly common (7). There has been an increasing trend in primary hip arthroplasty, especially in the younger patient, towards conservative bone sparing options with proximal fixation (8).

Joint registry data show increasing use of modular, distally fixed revision stems (9), which appear to offer excellent clinical and radiographic results, with the reassurance of potential whole stem osteointegration. Many of these stems have little or no metaphyseal fixation. Revision surgery of such stems can be technically challenging and may result in extensive destruction of diaphyseal bone stock. This limits and complicates the reconstructive options, usually necessitating the use of long implants, which may, in the absence of a good isthmic fix, require augmented fixation screws.

Conversion of a distally fixed, revision femoral stem to a proximally fixed prosthesis is a viable option in patients where adequate proximal bone stock can be identified. Meticulous pre-operative planning and implant choice are important, as is proximal fixation, especially in the younger patient. In planning revision surgery it is essential to consider the possibility of further revision, and to use the most conservative option compatible with an acceptable outcome.

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REFERENCES

1. Birrell F, Johnell O, Silman A. Projecting the need for hip replacement over the next three decades: influence of changing demography and threshold for surgery. Ann Rheum Dis 1999; 58: 569-72.
2. Crowninshield RD, Maloney WJ, Wentz DH, Levine DL. The role of proximal femoral support in stress development within hip prostheses. Clin Orthop Relat Res 2004; 420: 176-80.
3. Paprosky WG, Weeden SH, Bowling JW Jr. Component removal in revision total hip arthroplasty. Clin Orthop Relat Res 2001; 393:181-93.
4. Burstein G, Yoon P, Saleh KJ. Component removal in revision total hip arthroplasty. Clin Orthop Relat Res 2004; 420: 48-54.
5. Barrack RL. Preoperative planning for revision total hip arthroplasty. Clin Orthop Relat Res 2004; 420: 32-8.
6. Masri BA, Mitchell PA, Duncan CP. Removal of solidly fixed implants during revision hip and knee arthroplasty. J Am Acad Orthop Surg 2005; 13: 18-27.
7. Kulkarni M, Wylde V, Aspros D, Learmonth ID. Early clinical experience with a metaphyseal loading implant: Why have a stem? Hip Int 2006; 16 (suppl 3): 3-8.
8. Learmonth ID. Foreword. Hip Int 2006; 16 (suppl 3): 3-8.
9. Preetesh DP, Klika AK, Murray TG, Elsharkawy KA, Krebs VE, Barsoum WK. Influence of technique with distally fixed modular stems in revision total hip arthroplasty. J Arthroplasty 2009; 25: 926-31.